

Serial No.: 09/824,332 Filed: 4/2/2001
Amendment dated: April 5, 2004
Reply to Office Action of: 2/2/2004
Atty. Docket No.: MAC-0113

LISTING OF CLAIMS:

Claims 1-14 (canceled)

Claim 15 (currently amended) An apparatus for atomizing apparatus used within a fluidized catalytic cracking unit to atomize a fluid, said apparatus comprising:

- (a) a central passageway for allowing a fluid to be atomized to pass therethrough;
- (b) an atomization zone positioned downstream from and in fluid communication with, said central passageway;
- (c) and a plurality of atomization fluid passageways, comprising steam, configured to fluidly communicate with the central passageway via atomization fluid passageway outlets, wherein the atomization fluid passageway outlets have an angle greater than 60° to the central passageway and are positioned concentrically about a perimeter of the central passageway;
- (d) a heating zone configured to promote heat exchange between the central passageway and the plurality of atomization fluid passageways to superheat said steam, wherein the heating zone is positioned upstream from the atomization zone; and
- (e) a mixing zone comprising a first inlet for a fluid to be atomized and a second inlet positioned upstream of said central passageway from said atomizing fluid passageway outlets, which second inlet is a sparger which is comprised of a cylindrical conduit containing a plurality of sparger fluid passageways to allow the passage of sparger fluid into said mixing zone, and which mixing zone is in fluid communication with said central passageway.

Claims 16 -17 (canceled)

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Claim 18 (original) The apparatus according to claim 15 wherein the central passageway has a cross-section having two-dimensions, wherein at least one of the two dimensions converges in a downstream direction along at least a portion of the length of the central passageway.

Claim 19 (previously presented) The apparatus according to claim 15 wherein the atomization zone has a cross-section comprising two dimensions and wherein at least one of the dimensions diverges in a downstream direction along at least a portion of the length of the atomization zone.

Claim 20 (currently amended) An apparatus for atomizing apparatus used within a fluidized catalytic cracking unit to atomize a fluid, said apparatus comprising:

- (a) a central passageway for allowing a fluid to be atomized to pass therethrough;
- (b) an atomization zone positioned downstream from and in fluid communication with, said central passageway;
- (c) a plurality of atomization fluid passageways, comprising steam, configured to fluidly communicate with the central passageway via atomization fluid passageway outlets, wherein the atomization fluid passageway outlets have an angle greater than 60° to the central passageway and are positioned concentrically about a perimeter of the central passageway;
- (d) a heating zone configured to promote heat exchange between the central passageway and the plurality of atomization fluid passageways to superheat said steam, wherein the heating zone is positioned upstream from the atomization zone;
- (e) a stream splitter positioned within the central passageway upstream from the atomization fluid passageway outlets; and
- (f) a mixing zone comprising a first inlet for a fluid to be atomized and a second inlet positioned upstream of said central passageway from said atomizing fluid passageway outlets, which second inlet is a sparger which is comprised of a cylindrical conduit containing a plurality

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of sparger fluid passageways to allow the passage of sparger fluid into said mixing zone, and which mixing zone is fluid communication with said central passageway;

wherein the central passageway has a cross-section comprising two-dimensions, wherein at least one of the two dimensions converges in a downstream direction along at least a portion of the length of the central passageway, wherein the atomization zone has a cross-section comprising two dimensions and wherein at least one of the dimensions diverges in a downstream direction along at least a portion of the length of the atomization zone.

Claims 21 - 24 (canceled)

Claim 25 (previously presented) The apparatus according to claim 20 wherein the converging dimension of the central passageway and the diverging dimension of the atomization zone are coplanar.

Claim 26 (original) A fluidized catalytic cracking unit comprising a reactor comprising at least one feed nozzle, wherein at least one of the feed nozzles comprises:

- (i) a central passageway comprising at least one FCC feed inlet;
- (ii) an outlet comprising an atomization zone in fluid communication with the reactor;
- (iii) at least one atomization fluid passageway fluidly communicating with the central passageway via an atomization fluid passageway outlet; and,
- (iv) a heating zone configured to promote heat exchange between the FCC feed and the atomization fluid before the FCC feed and atomization fluid mix.

Claim 27 (original) The fluidized catalytic cracking unit according to claim 26 wherein the at least one feed nozzle further comprises a first mixing zone comprising a second inlet for an atomization fluid positioned upstream from the atomization fluid passageway outlet.

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Claim 28 (original) The fluidized catalytic cracking unit according to claim 27 wherein the second inlet comprises a sparger.

Claim 29 (original) The fluidized catalytic cracking unit according to claim 26 wherein the central passageway further comprises a stream splitter positioned within the central passageway upstream from the position at which the atomization fluid passageway exits into the central passageway.

Claim 30 (original) The fluidized catalytic cracking unit according to claim 26 wherein the atomization fluid passageway outlets have a forward acute angle greater than 60°.

Claim 31 (original) The fluidized catalytic cracking unit according to claim 26 wherein the central passageway has a circular cross-section and wherein the atomization fluid passageway outlets are positioned concentrically about the central passageway.

Claim 32 (original) The fluidized catalytic cracking unit according to claim 26 wherein the central passageway has a cross-section having two-dimensions, wherein at least one of the two dimensions converges in a downstream direction along at least a portion of the length of the central passageway.

Claim 33 (original) The a fluidized catalytic cracking unit according to claim 26 wherein the atomizing zone further comprises a spray distributor comprising a fluid passageway extending therethrough.

Claim 34 (original) The fluidized catalytic cracking unit according to claim 33 wherein the spray distributor fluid passageway has a cross-section comprising two dimensions and wherein at least

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one of the dimensions diverges in a downstream direction along at least a portion of the length of the spray distributor fluid passageway.

Claim 35 (original) The fluidized catalytic cracking unit according to claim 32 wherein the atomizing zone further comprises a spray distributor comprising a fluid passageway extending therethrough and wherein the spray distributor fluid passageway has a cross-section comprising two dimensions and wherein at least one of the dimensions diverges in a downstream direction along at least a portion of the length of the spray distributor fluid passageway.

Claim 36 (original) The fluidized catalytic cracking unit according to claim 35 wherein the converging dimension of the central passageway and the diverging dimension of the spray distributor fluid passageway are co-planar.

Claim 37 (previously presented) The apparatus according to claim 25 wherein the central passageway has a cross-section having two-dimensions, wherein both dimensions converge in a downstream direction along at least a portion of the length of the central passageway.

Claim 38 (previously presented) The apparatus according to claim 25 comprising a plurality of the feed nozzles.

Claim 39 (canceled)

Claim 40 (original) The apparatus according to claim 15 wherein the central passageway has a cross-section having two-dimensions, wherein both dimensions converge in a downstream direction along at least a portion of the length of the central passageway.

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Claim 41 (currently amended) A nozzle for atomizing a petroleum product used within a fluidized catalytic cracking unit to atomize the feed to said fluidized catalytic cracking unit, said nozzle comprising:

- (a) a central passageway for allowing a fluid petroleum feed to be atomized to pass therethrough;
- (b) an outlet comprising an atomization zone and a spray distributor positioned downstream from and in fluid communication with, said central passageway, which spray distributor is configured to promote a predetermined spray pattern;
- (c) a plurality of atomization fluid passageways fluidly communicating with the central passageway via atomization fluid passageway outlets, wherein the atomization fluid passageway outlets have an angle greater than 60° to the central passageway and are positioned concentrically about a perimeter of the central passageway;
- (d) a heating zone configured to promote heat exchange from the petroleum feed [and the] to an atomization fluid before the petroleum feed and the atomization fluid mix; and
- (e) a second inlet positioned upstream of said central passageway from said atomizing fluid passageway outlets, which second inlet is a sparger which is comprised of a cylindrical conduit containing a plurality of sparger fluid passageways.

Claims 42 - 43 (canceled)

Claim 44 (original) The nozzle according to claim 41 wherein the central passageway further comprises a stream splitter positioned within the central passageway upstream from the position at which the atomization fluid passageway exits into the central passageway.

Claim 45 (canceled)

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Claim 46 (original) The nozzle according to claim 41 wherein the central passageway has a circular cross-section and wherein the atomization fluid passageway outlets are positioned concentrically about the central passageway.

Claim 47 (original) The nozzle according to claim 41 wherein the central passageway has a cross-section having two-dimensions, wherein at least one of the two dimensions converges in a downstream direction along at least a portion of the length of the central passageway.

Claims 48 - 49 (canceled)

Claim 50 (original) The nozzle according to claim 49 wherein the converging dimension of the central passageway and the diverging dimension of the spray distributor fluid passageway are coplanar.

Claim 51 (canceled)

Claim 52 (previously presented) The apparatus according to claim 18 wherein said sparger comprises at least one fluid passageway configured to allow fluid passage into said central passageway, wherein said sparger fluid passageways are configured to promote radial flow, axial flow, or combinations thereof, said flow relative to the overall direction of fluid flow in said central passageway.

Claim 53 (canceled)

Claim 54 (original) The apparatus according to claim 28 wherein said sparger comprises at least one fluid passageway configured to allow fluid passage into said central passageway, wherein said sparger fluid passageways are configured to promote radial flow, axial flow, or

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combinations thereof, said flow relative to the overall direction of fluid flow in said central passageway.

Claim 55 (original) The apparatus according to claim 43 wherein said sparger comprises at least one fluid passageway configured to allow fluid passage into said central passageway, wherein said sparger fluid passageways are configured to promote radial flow, axial flow, or combinations thereof, said flow relative to the overall direction of fluid flow in said central passageway.

Claim 56 (previously presented) The apparatus of claim 15 wherein the plurality of sparger fluid passageways are configured to promote radial flow, axial flow, or a combination thereof, said flow relative to the overall direction of fluid flow through said central passageway.

Claim 57 (previously presented) The apparatus of claim 20 wherein the plurality of sparger fluid passageways are configured to promote radial flow, axial flow, or a combination thereof, said flow relative to the overall direction of fluid flow through said central passageway.